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12:27 PM

Work, Power and Efficiency ch10

Work:

= change in energy
= force · displacement
if they are in the same direction W=Fd
W=0 if F is perpendicular to d
work is negative if F is opposite to d
Work is a scalar - no direction
units: Joule, J=Nm

Power, P

is the rate of doing work or the rate of change in energy
P=W/t = change in energy/time
units: Watts, W = J/s
(1 horsepower, hp = 746 W)
electricity is sold in units of kWhrs kilowatt-hours
we only pay 8 cents/kWhr up to a point,

and then 12 cents after that.

eg.

1. You run a 100.0W light bulb for 8.00 hours a day for a year.

a) How many kWhrs of energy do you use in a year? How many Joules?

b) How much does that cost at 12 cents/kWhrs?

c) If you use a high efficiency bulb, it uses 1/4 the energy to produce equivalent light. How much money do you save a year?

2. Mini - Lab - determine your mass using a scale or just say 50kg
   Measure the height of the stairs
   (one stair x number of stairs)
   time yourself going up the stairs
   touching each stair. (don't run down stairs, don't kill yourself)
   calculate your power

a) in Watts b) in horsepower

a) P=W/t = energy/time
energy = P x t = 100W x 8hrs/day x 365.25 days/year = 292 KWhrs per year
100x8x365.25=292,200
W = J/s
292 x 1000 J/s 3600s = 1.05×10^9J
or 1.05 GJ

b) 0.12 x 292=$35/year

c) you save 3/4x35=$26/year

2. eg. Mr Klaassen is about 100kg
h= 0.175 x 20=3.5 m
W=Fxd = 100kg x 9.80N/kg x 3.5m
100x9.8x3.5=3,430.0 J
P = W/t = 3 430J/10s= 343W
343W (hp/746W) = 343/746=0.4598
0.46hp